WHAT IS CLAIMED IS:

1. A method for manufacutring silica glass comprising:

a first step of allowing an organosilicon compound to react in an oxidizing flame while ejecting an organosilicon compound and an inactive gas from a tube placed in the center of a burner with multi-tubular structure and ejecting an oxygen gas and a hydrogen gas from a tube placed around the tube in the center of said burner so that a ratio (a/b) of the total oxygen gas amount (a) to the total hydrogen amount (b) is 0.53 or more, so as to obtain silica glass fine particles; and

a second step of depositing and melting said silica glass fine particles on a heat resistant target opposed to said burner, so as to obtain a silica glass ingot.

2. A method according to claim 1, wherein a ratio ([a-c]/b) of an oxygen gas amount (a-c) obtained by subtracting an oxygen gas amount (c) consumed by combustion of the organosilicon compound emitted from said burner from the total oxygen gas amount (a) to the total hydrogen gas amount (b) is 0.48 or more.

3. A method according to claim 1, wherein said organosilicon compound is at least one kind selected from the group consisting of alkoxysilanes and siloxanes.

4. A method according to claim 1, wherein said organosilicon compound is at least one kind selected from the group consisting of tetraethoxysilane, tetramethoxysilane, methyltrimethoxysilane, hexamethyldisiloxane, octamethylcyclotetrasiloxane, and tetramethylcyclotetrasiloxane.

5. A method according to claim 1, wherein said burner comprises:

a first tube placed in a center for ejecting material gas of an organosilicon compound and an inactive gas;

a second tube placed in a co-centric circle around said first tube for ejecting a first hydrogen gas;

a third tube placed in a co-centric circle around said second tube for ejecting a first oxygen gas;

a fourth tube placed in a co-centric circle around said third tube for ejecting a second hydrogen gas;

a fifth set of a plurality of tubes placed between an outer periphery of said third tube and an inner periphery of said fourth tube for ejecting a second oxygen gas;

a sixth tube placed in a co-centric circle, said sixth tube for ejecting a third hydrogen gas; and

a seventh set of a plurality of tubes placed between an outer periphery of said fourth tube and an inner periphery of said sixth tube for ejecting a third oxygen gas.

6. A method according to claim 5, wherein a ratio (e/d) of the first oxygen gas amount (e) to the first hydrogen gas amount (d) is 0.50 or less and a ratio (g/f) of the second oxygen gas amount (g) to the second hydrogen gas amount (f) is 0.55 or more in said first step.

7. A method according to claim 5, wherein a ratio (e/d) of the first oxygen gas amount (e) to the first hydrogen gas amount (d) and a ratio (g/f) of the second oxygen gas amount (g) to the second hydrogen gas amount (f) indicate excessive oxygen level relative to a theoretical combustion ratio and a ratio (i/h) of the third oxygen gas amount (i) to the third hydrogen gas amount (h) indicates excessive hydrogen level relative to a theoretical combustion ratio in said first step, and

the method further comprises a third step of heat treating said silica glass ingot under an atmosphere containing hydrogen.

8. A method according to claim 7, wherein a ratio (e/d) of the first oxygen gas amount (e) to the first hydrogen gas amount (d) is 0.7 or more and 2.0 or less, a ratio (g/f) of the second oxygen gas amount (g) to the second hydrogen gas amount (f) is 0.5 or more and

1.0 or less, and a ratio (i/h) of the third oxygen gas amount (i) to the third hydrogen gas amount (h) is 0.2 or more and 0.5 or less in said first step.

9. A method according to claim 7, wherein a hydrogen molecule concentration in the atmosphere where said silica glass ingot is heat treated is 5wt% or more and 100wt% or less.

10. A method according to claim 7, wherein a temperature of the atmosphere where said silica glass ingot is heat treated is 500°C or less.

11. A method according to claim 7, further comprising a fourth step of heat treating said silica glass ingot at the temperature of 700°C or more under an atmosphere with an oxygen partial pressure of 0.1 atm or more either between said second step and said third step or after said third step.

12. A method according to claim 8, wherein a flow rate of said first hydrogen gas is 60 m/sec or less.

13. A reduction projection exposure apparatus having an exposure light source, a photomask formed with an original image of a pattern, an irradiation optical system for irradiating said photomask with the light emitted from said light source, a projection optical system for projecting onto a photosensitive substrate a pattern image projected from said photomask, and an alignment system for aligning said photomask and said photosensitive substrate with each other;

wherein at least a part of lenses constituting said irradiation optical system, lenses constituting said projection optical system and said photomask is an optical member made of silica glass synthesized by the direct method where a material gas comprising an organosilicon compound is allowed to react in an oxidizing flame,

said optical member having a 2×10^{14} molecules/cm^3 or less concentration of formyl radical generated by X-ray irradiation whose dose is 0.01 Mrad or more and 1 Mrad or less.

14. An apparatus according to claim 13, wherein all of the lenses made of silica glass constituting said irradiation optical system and irradiation projection optical system are optical members made of silica glass synthesized by the direct method where a material gas comprising an organosilicon compound is allowed to react in an oxidizing flame,

said optical members having a 2×10^{14} molecules/cm^3 or less concentration of formyl radical generated by X-ray irradiation whose dose is 0.01 Mrad or more and 1 Mrad or less.

15. An apparatus according to claim 13, wherein said photomask is an optical member made of silica glass synthesized by the direct method where a material gas comprising an organosilicon compound is allowed to react in an oxidizing flame,

said optical member having a 2×10^{14} molecules/cm^3 or less concentration of formyl radical generated by X-ray irradiation whose dose is 0.01 Mrad or more and 1 Mrad or less.